



High-Pressure CAT

Overview

The High-Pressure Collaborative Access Team (HP-CAT) currently has three institutional members: the Carnegie Institution of Washington (managing member), Lawrence Livermore National Laboratory, and the University of Nevada, Las Vegas. These members pool resources and share expertise for the design, development, and construction of sector 16. The purpose of HP-CAT is to provide its members with facilities for state-of-the-art educational and research activities and to assist the members and general users in operating these facilities; the goal is to advance high-pressure research with synchrotron radiation. The overriding aim of HP-CAT is to set up a world-leading high-pressure research center at the APS for the scientific community.

Research Focus

Extreme pressure conditions radically alter the properties of materials. With the recent advances and developments in the technology of pressure vessels, which can now reach several hundreds of gigapascal (1 GPa = 10 kbar), the pressure variable promises to add a whole new dimension in fundamental physics, chemistry, earth and planetary sciences, and material science and technology. HP-CAT is dedicated to the scientific exploration of these fields using state-of-the-art synchrotron radiation instrumentation and a common focus on the high-pressure dimension.

In ultrahigh pressure research, the power of an integrated approach is far greater than the sum of individual techniques. Comprehensive understanding of high-pressure phenomena relies on the combination of complementary measurements. HP-CAT integrates x-ray diffraction and spectroscopy with samples at high pressures and variable temperatures (from cryogenic conditions to thousands of degrees). These techniques include single-crystal structure refinement using energy-dispersive x-ray diffraction, high-resolution angle-dispersive polycrystalline x-ray diffraction, high-resolution x-ray emission spectroscopy, x-ray absorption spectroscopy, nuclear resonance forward scattering, inelastic x-ray scattering, and Compton scattering. The structural, vibrational, electronic, and magnetic properties of materials can thus be measured *in situ* to identify novel phenomena and transitions at high pressures.

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